THE HEALTH-SUPPORTING BENEFITS OF COCONUTS

Scientific research proves that the saturated fatty acids and derivative compounds found in coconuts and coconut oil have significant benefits for a healthy immune system and metabolism.

Part 2 of 2

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The following is the second part of a talk and paper, "Coconuts: In Support of Good Health in the 21st Century", presented by Dr Mary Enig at the Asian Pacific Coconut Community (APCC) meeting held in Pohnpei in the Federated States of Micronesia in 1999. Note that it does make several references to animal experiments, and that* NEXUS *does not condone animal experimentation. Editor.

VI. THE LATEST ON THE *TRANS* FATTY ACIDS

Both the United States and Canada will soon require labelling of the *trans* fatty acids, which will put coconut oil in a more competitive position than it has been in the past decade. (In 2001, Canada published examples of the labels it plans to use, while the US is still to finalise its labels.)

A fear of the vegetable oil manufacturers has always been that they would have to label *trans* fatty acids. The producers of *trans* fatty acids have relied on the anti–saturated fat crusade to protect their markets. However, the latest research on saturated fatty acids and *trans* fatty acids shows the saturated fatty acids coming out ahead in the health race.

It has taken a decade, from 1988 to 1998, to see changes in perception. During this period, the *trans* fatty acids have taken a deserved drubbing. Research reports from Europe have been emerging since the seminal report by Mensink and Katan in 1990 that the *trans* fatty acids raised the low-density lipoprotein (LDL) cholesterol and lowered the high-density lipoprotein (HDL) cholesterol in serum. This has been confirmed by studies in the US (Judd et al., 1994; Khosla and Hayes, 1996; Clevidence, 1997).

In 1990, the Lipids Research Group at the University of Maryland published a paper (Enig et al., 1990) correcting some of the erroneous data sponsored by the food industry in the 1985 review of the *trans* fatty acids by the Life Sciences Research Office of the Federation of American Societies for Experimental Biology (LSRO–FASEB) (Senti, 1985).

In 1993, a group of researchers at Harvard University, led by Professor Walter Willett, reported a positive relationship between the dietary intake of the *trans* fatty acids and coronary heart disease in a greater than 80,000 cohort of nurses who had been followed by the School of Public Health at Harvard University for more than a decade.

Pietinen and colleagues (1997) evaluated the findings from the large cohort of Finnish men who were followed in a cancer prevention study. After controlling for the appropriate variables including several coronary risk factors, the authors observed a significant positive association between the intake of *trans* fatty acids and the risk of death from coronary disease. There was no association between the intake of saturated fatty acids or dietary cholesterol and the risk of coronary death. This is another example of the differences between the effects of the *trans* fatty acids and the saturated fatty acids, and a further challenge to the dietary cholesterol hypothesis.

The issue of the *trans* fatty acids as a causative factor in cancer remains underexplored, but recent reports have found a connection. Bakker and colleagues (1997) studied the data for the association between breast cancer incidence and linoleic acid status across European countries, since animal and ecological studies had suggested a relationship. They found that the mean fatty acid composition of adipose did not show an association with omega-6 linoleic acid and breast, colon or prostate cancer. However, cancers of the breast and colon were positively associated with the *trans* fatty acids. Kohlmeier and colleagues (1997) also reported that data from the EURAMIC study showed adipose tissue concentration of *trans* fatty acids having a positive association with postmenopausal breast cancer in European women.

In 1995, a British documentary on the *trans* fatty acids was aired on a major television station in the UK. This documentary included an exposé of the battle between the edible oil industry and some of the major researchers of the *trans* fatty acids. Just this year [1999], this same documentary was aired on television in France, where it had been requested by a major television station. Several of the early researchers into the *trans* problems, including Professor Fred Kummerow and Dr George Mann, have continued their research and/or writing (Kummerow, 1999, 2000; Mann, 1994, 2000). The popular media have continued to press the issue of the amounts of *trans* in foods, for which there are still no comprehensive government databases.

A recently published paper from a US Department of Agriculture researcher states: "Because *trans* fatty acids have no known health benefits and strong presumptive evidence suggests that they contribute markedly to the risk of developing CHD, the results published to date suggest that it would be prudent to lower the intake of *trans* fatty acids in the US diet" (Nelson, 1998).

Professor Meir Stampfer from Harvard University refers to *trans* fats as "one of the major nutritional issues of the nation", contending that "they have a large impact" and that "we should completely eliminate hydrogenated fats from the diet" (Gottesman, 1998).

Lowering the *trans* fatty acids in foods in the US can only be done by returning to the use of the natural, unhydrogenated and more saturated fats and oils.

Predictions can be made regarding the future of *trans* fatty acids. Our ability to predict has been pretty good; for example, when Enig Associates started producing the marketing newsletter *Market Insights*, written by Eric Enig, we predicted that *trans* fatty acids would eventually be swept out of the market. It appears that this prediction may be close to coming true.

Also in the early 1990s, *Market Insights* predicted that the Center for Science in the Public Interest (CSPI) would change its mind about the *trans* fatty acids, which it had spent years defending. CSPI did change its mind, and in fact went on the attack regarding the *trans*, but CSPI never admitted that it had originally been promoting *trans* or that the high levels of *trans* fatty acids found in the fried foods in fast food and other restaurants and in many other foods are directly due to CSPI lobbying. While its change was welcome, CSPI's revisionist version of its own history of support of partially hydrogenated oils and *trans* fatty acids would have fitted perfectly into George Orwell's *Nineteen Eighty-Four*.

Cholesterol is a major support molecule for the immune system, an important antioxidant and a necessary component of neurotransmitter receptors.

Our brains do not work very well without adequate cholesterol.

VII. COMPARISON OF SATURATED FATS WITH THE *TRANS* FATS

The statement that *trans* fatty acids are like saturated fatty acids is not correct for biological systems. A listing of the biological effects of saturated fatty acids in the diet versus the biological effects of *trans* fatty acids in the diet is in actuality a listing of the good (saturated) versus the bad (*trans*).

When one compares the saturated fatty acids and the *trans* fatty acids, we see that:

1) saturated fatty acids raise HDL cholesterol, the so-called "good cholesterol", whereas the *trans* fatty acids lower HDL cholesterol (Mensink and Katan, 1990; Judd et al., 1994);

2) saturated fatty acids lower the blood levels of the atherogenic lipoprotein (a), whereas *trans* fatty acids raise the blood levels of lipoprotein (a) (Khosla and Hayes, 1996; Hornstra et al., 1991; Clevidence et al., 1997);

3) saturated fatty acids conserve the elongated omega-3 fatty acids (Gerster, 1998), whereas *trans* fatty acids cause the tissues to lose these omega-3 fatty acids (Sugano and Ikeda, 1996);

4) saturated fatty acids do not inhibit insulin binding, whereas *trans* fatty acids do inhibit insulin binding;

5) saturated fatty acids are the normal fatty acids made by the body and they do not interfere with enzyme functions such as the delta-6-desaturase, whereas *trans* fatty acids are not made by the body and they interfere with many enzyme functions such as delta-6-desaturase; and

6) some saturated fatty acids are used by the body to fight viruses, bacteria and protozoa and they support the immune system, whereas *trans* fatty acids interfere with the function of the immune system.

VIII. WHAT ABOUT THE UNSATURATED FATS?

The arteries of the heart are also compromised by the unsaturated fatty acids. When the fatty acid composition of the plaques (atheromas) in the arteries has been analysed, the level of saturated fatty acids in the cholesterol esters is only 26% compared to that in the unsaturated fatty acids, which is 74%. When the unsaturated fatty acids in the cholesterol esters in these plaques are analysed, it is shown that 38% are polyunsaturated and 36% are monounsaturated. Clearly, the problem is not with the saturated fatty acids.

As an aside, you need to understand that the major role of cholesterol in heart disease and cancer is as the body's repair substance and that cholesterol is a major support molecule for the immune system, an important antioxidant and a necessary component of neurotransmitter receptors. Our brains do not work very well without adequate cholesterol. It should be apparent to scientists that the current approach to cholesterol has been wrong.

The pathway to cholesterol synthesis starts with a molecule of acetyl CoA [coenzyme A] that comes from the metabolism of excess protein-forming ketogenic amino acids and from the metabolism of excess carbohydrates as well as from the oxidation of excess fatty acids. Grundy in 1978 reported that the degree of saturation of the fat in the diet did not affect the rate of synthesis of cholesterol. However, research reported by Jones in 1997 showed that the polyunsaturated fatty acids in the diet increase the rate of cholesterol synthesis relative to other fatty acids. Furthermore, research reported in 1993 (Hodgsons et al.) showed that dietary intake of the omega-6 polyunsaturated fatty acid, linoleic acid, was positively related to coronary artery disease.

Thus, those statements made by the consumer activists in the United States, to the effect that the saturated fatty acids increase cholesterol synthesis, are without any foundation.

What happens when there is an increase or a decrease of cholesterol in the serum is more like a shift from one compartment to another as the body tries to rectify the potential damage from the excess polyunsaturated fatty acids. Research by Dr Hans Kaunitz (1978) clearly showed the potential problems with excess polyunsaturated fatty acids.

IX. RESEARCH SHOWING BENEFICIAL EFFECTS OF EATING THE MORE SATURATED FATS

One major concern expressed by the nutrition community is related to whether or not people are getting enough elongated omega-3 fatty acids in their diets. The elongated omega-3 fatty acids of concern are eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Some research has shown that the basic omega-3 fatty acid, linolenic acid, is not readily converted to the elongated forms in humans or animals, especially when there is ingestion of the *trans* fatty acids and the consequent inhibition of the delta-6-desaturase enzyme. One recent study (Gerster, 1998), which used radioisotope-labelled linolenic acid to measure this conversion in adult humans, showed that if the background fat in the diet was high in saturated fat, the conversion was approximately 6% for EPA and 3.8% for DHA; whereas, if the background fat in the diet was high in omega-6 polyunsaturated fatty acids (PUFA), the conversion was reduced 40–50%.

Nanji and colleagues (1995) reported that a diet enriched with saturated but not unsaturated fatty acids reversed the alcoholic liver injury in their animals which was caused by dietary linoleic acid. These researchers concluded that this effect may be explained by the down-regulation of lipid peroxidation. This is another example of the need for adequate saturated fat in the diet.

Cha and Sachan (1994) studied the effects of saturated fatty acid and unsaturated fatty acid diets on ethanol pharmacokinetics. The hepatic enzyme alcohol dehydrogenase and plasma carnitines were also evaluated. The researchers concluded that dietary saturated fatty acids protect the liver from alcohol injury by retarding ethanol metabolism, and that carnitine may be involved.

Hargrove and colleagues (1999) noted the work of Nanji et al. and postulated that they would find that diets rich in linoleic acid would also cause acute liver injury after acetaminophen injection. In the first experiment, two levels of fat (15g/100g protein and 20g/100g protein), using corn oil or beef tallow, were fed. Liver enzymes indicating damage were significantly elevated in all the animals except for those animals fed the higher level of beef tallow. These researchers concluded that "diets with high [linoleic acid] may promote acetaminophen-induced liver injury compared to diets with more saturated and mono-unsaturated fatty acids".

X. RESEARCH SHOWING GENERAL BENEFICIAL EFFECTS FROM CONSUMING COCONUT OIL

Research that compares the feeding of coconut oil with other oils to answer a variety of biological questions is increasingly finding beneficial results from the coconut oil.

Obesity is a major health problem in the United States and the subject of much research. Several lines of research dealing with metabolic effects of high-fat diets have been followed. One study used coconut oil to enrich a high-fat diet and the results reported were that the "coconut oil–enriched diet is effective in...[producing]...a decrease in white fat stores" (Portillo et al., 1998).

Cleary et al. (1999) fed genetically obese animals high-fat diets of either safflower oil or coconut oil. Animals fed safflower oil had higher hepatic lipogenic enzyme activities than did animals fed coconut oil. When the number of fat cells was measured, the safflower oil fed also had more fat cells than the coconut oil fed.

Many of the feeding studies produce results at variance with the popular conception. High-fat diets have been used to study the effects of different types of fatty acids on membrane phospholipid fatty acid profiles. When such a study was performed on mice, the phospholipid profiles were similar for diets high in linoleic acid from high-linoleate sunflower oil relative to diets high in saturated fatty acids from coconut oil. However, those animals fed diets high in oleic acid (from the high-oleate sunflower oil) or high in elongated omega-3 fatty acids (from menhaden fish oil) were not only different from the other two diets, but they also resulted in enlarged spleens in the animals (Huang and Frische, 1992).

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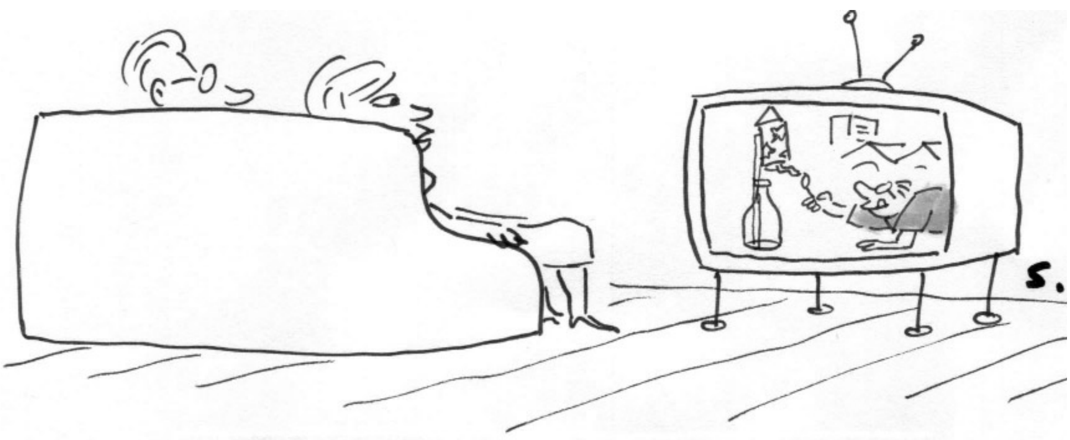

"Man, these NASA budget cuts are getting to be murder."

Oliart-Ros and colleagues (1998) at the Instituto Tecnológico de Veracruz, Mexico, reported on effects of different dietary fats on sucrose-induced cardiovascular syndrome in rats. The most significant reduction in parameters of the syndrome was obtained by the n-3 PUFA-rich diet. These researchers reported that the diet thought to be PUFA-deficient presented a tissue lipid pattern similar to the n-3 PUFA-rich diet (fish oil), which surprised and puzzled them. When the researchers were questioned, it turned out that the diet was not really PUFA-deficient, but rather just a normal coconut oil (nonhydrogenated) which conserved the elongated omega-3 and normalised the omega-6 to omega-3 balance.

A recent study measured the effect of high-fat diets, fed for more than three months to neonatal pigs, on the HMG-CoA reductase enzyme's function and gave some surprises. There were two feeding protocols: one with the added cholesterol and one without added cholesterol, but both with coconut oil. The hepatic reductase activity, which was the same in all groups at the beginning of the feeding on the third day and similar on the 42nd day, was increased with and without added cholesterol on the 13th day and then decreased on the 25th day. The data were said to suggest that dietary cholesterol suppressed hepatic reductase activity in the young pigs regardless of their genetic background, that the stage of development was a dominant factor in its regulation, and that both dietary and endogenously synthesised cholesterol were used primarily for tissue building in very young pigs (McWhinney et al., 1996). The feeding of coconut oil did not in any way compromise the normal development of these animals.

When compared with feeding coconut oil, feeding two different soybean oils to young females caused a significant decrease in HDL cholesterol. Both soybean oils, one of which was extracted from a new mutant soybean thought to be more oxidatively stable, were not protective of the HDL levels (Lu et al., 1997).

Trautwein et al. (1997) studied cholesterol-fed hamsters on different oil supplements for plasma, hepatic and biliary lipids. The dietary oils included butter, palm stearin, coconut oil, rapeseed oil, olive oil and sunflowerseed oil. Plasma cholesterol concentrations were higher (9.2 millimoles/litre) for olive oil than for coconut oil (8.5 mmol/L), hepatic cholesterol was highest in the olive oil group, and none of the diet groups differed for biliary lipids. Even in this cholesterol-sensitive animal model, coconut oil performed better than olive oil.

Smit and colleagues (1994) had also studied the effect of feeding coconut oil compared with feeding corn oil and olive oil in rats, and measured the effect on biliary cholesterol. Bile flow was not different between the three diets, but the hepatic plasma membranes showed more cholesterol and less phospholipid from corn and olive oil feeding relative to coconut oil feeding.

Several studies (Kramer et al., 1998) have pointed out problems with canola oil feeding in newborn piglets, which results in a reduction in the number of platelets and alteration in their size. There is concern for similar effects in human infants. These undesirable effects can be reversed when coconut oil or other saturated fat is added to the feeding regimen (Kramer et al., 1998).

Research has shown that coconut oil is needed for good absorption of fat and calcium from infant formulas. The soy oil (47%) and palm olein (53%) formula gave 90.6% absorption of fat and 39% absorption of calcium, whereas the soy oil (60%) and coconut oil (40%) gave 95.2% absorption of fat and 48.4% absorption of calcium (Nelson et al., 1996). Both fat and calcium are needed by the infant for proper growth. These results clearly show the folly of removing or lowering the coconut oil content in infant formulas.

XI. RESEARCH SHOWING A ROLE FOR COCONUT IN ENHANCING IMMUNITY AND MODULATING METABOLIC FUNCTIONS

Coconut oil appears to help the immune system response in a beneficial manner. Feeding coconut oil in the diet completely abolished the expected immune factor responses to endotoxin that were seen with corn oil feeding. This inhibitory effect on interleukin-1 production was interpreted by the authors of the study as being largely due to a reduced prostaglandin and leukotriene production (Wan and Grimble, 1987). However, the damping may be due to the fact that effects from high omega-6 oils tend to be normalised by coconut oil feeding.

Another report from this group (Bibby and Grimble, 1990) compared the effects of corn oil and coconut oil diets on tumour necrosis factor-alpha and endotoxin induction of the inflammatory prostaglandin E2 (PGE2) production. The animals fed coconut oil did not produce an increase in PGE2, and the researchers again interpreted this as a modulatory effect that brought about a reduction of phospholipid arachidonic acid content.

Several recent studies are showing additional helpful effects of consuming coconut oil on a regular basis, thus supplying the body with the lauric acid derivative, monolaurin.

Another study from the same research group (Tappia and Grimble, 1994) showed that omega-6 oil enhanced inflammatory stimuli, but that coconut oil, along with fish oil and olive oil, suppressed the production of interleukin-1.

Several recent studies are showing additional helpful effects of consuming coconut oil on a regular basis, thus supplying the body with the lauric acid derivative, monolaurin. Monolaurin and the ether analogue of monolaurin have been shown to have the potential for damping adverse reactions to toxic forms of glutamic acid (Dave et al., 1997). Lauric acid and capric acid have been reported to have very potent effects on insulin secretion (Garfinkel et al., 1992). Using a model system of murine splenocytes, Witcher et al. (1996) showed that monolaurin induced proliferation of T-cells and inhibited the toxic shock syndrome toxin-1 mitogenic effects on T-cells.

Monserrat and colleagues (1995) showed that a diet rich in coconut oil could protect animals against the renal necrosis and renal failure produced by a diet deficient in choline (a methyl donor group). The animals had less or no mortality and increased survival time as well as decreased incidence or severity of the renal lesions when 20% coconut oil was added to the deficient diet. A mixture of hydrogenated vegetable oil and corn oil did not show the same benefits.

The immune system is complex and has many feedback mechanisms to protect it, but the wrong fat and oils can compromise these important mechanisms. The data from the several studies show the helpful effects of coconut fat. Additionally, there are anecdotal reports that consumption of coconut is beneficial for individuals with the chronic fatigue and immune dysfunction syndrome known as CFIDS.

XII. US PATENTS FOR MEDICAL USES OF LAURIC OILS, MEDIUM-CHAIN FATTY ACIDS AND THEIR DERIVATIVES SUCH AS MONOLAURIN

A number of patents have been granted in the United States for medical uses of lauric oils, lauric acid and monolaurin. Although one earlier patent was granted to Professor Kabara more than three decades ago, the rest of these patents have been granted within the past decade.

In 1989 a patent was issued to the New England Deaconess Hospital (Bistrian et al., 1989) for the invention titled "Kernel Oils and Disease Treatment". This treatment requires lauric acid as the primary fatty acid source, with lauric oils constituting up to 80% of the fat in the diet "using naturally occurring kernel oils".

In 1991 and 1995, two patents were issued to the group of researchers whose work has been reviewed above.

The first invention (Isaacs et al., 1991) was directed to antiviral and antibacterial activity of both fatty acids and monoglycerides, primarily against enveloped viruses. The claims are for "a method of killing enveloped viruses in a host human...wherein the enveloped viruses are AIDS viruses...[or]...herpes viruses...[and the]...compounds selected from the group consisting of fatty acids having from 6 to 14 carbon atoms and monoglycerides of said fatty acids...[and]...wherein the fatty acids are saturated fatty acids".

The second patent (Isaacs et al., 1995) was a further extension of the earlier one. This patent also includes discussion of the inactivation of enveloped viruses, and it specifically cites monoglycerides of caproic, caprylic, capric, lauric and myristic acids. These fatty acids make up more than 80% of coconut oil. Also included in this patent is a listing of susceptible viruses and some bacteria and protozoa.

Although these latter patents may provide the owners of the patents with the ability to extract royalties from commercial manufacturers of monoglycerides and fatty acids, they cannot require royalties from the human gastrointestinal tract when it is the "factory" that is doing the manufacturing of the monoglycerides and fatty acids.

Clearly, though, these patents serve to illustrate to us that the health-giving properties of monolaurin and lauric acid are well recognised by some individuals in the research arena, and they lend credence to our appropriate choice of lauric oils for promoting health and as an adjunct treatment of viral diseases.

XIII. HOW CAN WE GET SUFFICIENT COCONUT FAT INTO THE FOOD SUPPLY?

I would like to review for you my perception of the status regarding the coconut and coconut products markets in the United States and Canada at the end of the 20th century and the beginning of the 21st century.

Coconut products are trying to regain their former place in several small markets. The extraction of oil from fresh coconut has been reported in the past decade and my impression is that this is being considered as a desirable source of minimally processed oil with desirable characteristics for the natural foods market.

There have been some niche markets for coconut products developing during the past half-decade. These are represented primarily by the natural foods and health foods producers. Some examples are the new coconut butters produced in the US and Canada by Omega Nutrition and Carotec, Inc. And this is no longer as small a market as it has been in past years. Desiccated coconut products, coconut milk and even coconut oil are appearing on the shelves of many of these markets. After years of packaging coconut oil for skin use only, one of the large suppliers of oils to the natural foods and health foods stores has introduced coconut oil for food use, and it has appeared within the last few months on shelves in the Washington, DC, metropolitan area, along with other oils. I believe I indirectly had something to do with this turn of events.

XIV. CONCLUSIONS AND RECOMMENDATIONS

There is much to be gained from pursuing the functional properties of coconut for improving the health of humanity.

On the occasion of the 30th anniversary of the Asian Pacific Coconut Community, at this 36th meeting of APCC, I wanted to bring you a message that I hope will encourage you to continue your endeavours on behalf of all parts of the coconut industry. Coconut products for inedible and especially edible uses are of the greatest importance for the health of the entire world.

Some of what I have been telling you, most of you already know. But in saying these things for the record, it is my intention to tell those who did not know all the details until they heard or read this paper about the positive properties of coconut.

Coconut oil is a most important oil because it is a lauric oil.

Coconut oil is a most important oil because it is a lauric oil. The lauric fats possess unique characteristics for both food industry uses and also for the uses of the soaps and cosmetics industries. Because of the unique properties of coconut oil, the fats and oils industry has spent untold millions to formulate replacements from those seed oils so widely grown in the world outside the tropics. While it has been impossible to truly duplicate coconut oil for some of its applications, many food manufacturers have been willing to settle for lesser quality in their products. Consumers have also been willing to settle for a lesser quality, in part because they have been fed so much misinformation about fats and oils.

Desiccated coconut, on the other hand, has been impossible to duplicate, and the markets for desiccated coconut have continued. The powdered form of desiccated coconut now being sold in Europe and Asia has yet to find a market in the United States, but I predict that it will become an indispensable product in the natural foods industry. Creamed coconut, which is desiccated coconut very finely ground, could be used as a nut butter.

APCC needs to promote the edible uses of coconut, and it needs to promote the re-education of the consumer, the clinician and the scientist. The researcher H. Thormar (Thormar et al., 1999) concluded his abstract with the statement that monocaprin "is a natural compound found in certain foodstuffs such as milk and is therefore unlikely to cause harmful side effects in the concentrations used". It is not monocaprin that is found in milk, but capric acid. It is likely safe at most any level found in food. However, the level in milk fat is at most 2%, whereas the level in coconut fat is 7%.

One last reference for the record. Sircar and Kansra (1998) have reviewed the increasing trend of atherosclerotic disease and type-2 diabetes mellitus in the Indians from both the subcontinent of India and abroad. They note that over the time when there has been an alarming increase in the prevalence of these diseases, there has been a replacement of traditional cooking fats with refined vegetable oils that are promoted as heart-friendly, but which are being found to be detrimental to health. These astute researchers suggest that it is time to return to the traditional cooking fats like ghee, coconut oil and mustard oil.

There are a number of areas of encouragement. The nutrition community in the United States is slowly starting to recognise the difference between medium-chain saturated fatty acids and other saturated fatty acids. We predict now that the qualities of coconut, both for health and food function, will ultimately win out. ∞

Editor's Note:

As we have insufficient space to publish the numerous references accompanying this article, we have instead posted them on the NEXUS Magazine website, http://www.nexusmagazine.com.

About the Author:

Dr Mary G. Enig holds an MS and PhD in Nutritional Sciences from the University of Maryland in the USA. She is a consulting nutritionist and biochemist of international renown and an expert in fats/oils analysis and metabolism, food chemistry and composition and nutrition and dietetics.

Dr Enig is Director of the Nutritional Sciences Division of Enig Associates, Inc., President of the Maryland Nutritionists Association and a Fellow of the American College of Nutrition. She is also Vice President of the Weston A. Price Foundation and Science Editor of the Foundation's publication. Dr Enig has many years of experience as a lecturer and has taught graduate-level courses for the Nutritional Sciences Program at the University of Maryland, where she was a Faculty Research Associate in the Lipids Research Group, Department of Chemistry and Biochemistry. She also maintains a limited clinical practice for patients needing nutritional assessment and consultation.

Dr Enig has extensive experience consulting and lecturing on nutrition to individuals, medical and allied health groups, the food processing industry and state and federal governments in the US. She also lectures and acts as a consultant to the international health and food processing communities. Since 1995 she has been invited to make presentations at scientific meetings in Europe, India, Japan, Vietnam, Indonesia, the Philippines and Micronesia.

Dr Enig is the author of numerous journal publications, mainly on fats and oils research and nutrient/drug interactions. She also wrote the book *Know Your Fats* (Bethesda Press, Silver Spring, MD, May 2000). She is a popular media spokesperson and was an early critic speaking out about the use of *trans* fatty acids and advocating their inclusion in nutritional labelling. One of Dr Enig's recent research topics dealt with the development of a nutritional protocol for proposed clinical trials of a non-drug treatment for HIV/AIDS patients. Her articles, "The Oiling of America" and "Tragedy and Hype: The Third International Soy Symposium", written with nutritionist/researcher Sally Fallon, were published in NEXUS 6/01–2 and 7/03 respectively.